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EXAMINER	
WERNER, BRIAN P	

ART UNIT	PAPER NUMBER
2621	7

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/737,836	WALLACK, AARON S.	
	Examiner	Art Unit	
	Brian P. Werner	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-26 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-3,6-11,14-20 and 23-26 is/are rejected.

7)☒ Claim(s) 4,5,12,13,21 and 22 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 15 December 2000 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 1,5,6 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Objections

1. The numbering of claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution. When claims are canceled, the remaining claims must not be renumbered. When new claims are presented, they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

Misnumbered claim 13 (i.e., the second instance of claim 13, immediately preceding claim 15 in the sequence) has been renumbered claim 14.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-3, 6, 8-11, 14, 15. 17-20, 23, 24 and 26 are rejected under 35 U.S.C. 102(e) as being anticipated by Peurach et al. (US 6,173,066 B1).

Regarding **independent claims 1, 9 and 18**, Peurach discloses:

a computer implemented system for registering an object in six degrees of freedom (intended use limitation in the preamble, and not referred back to or recited in the body of the claim; however, Peurach meets this limitation anyway: see "matching of a model to the image relies upon a six-degree-of-freedom numerical fitting" at column 3, line 43; "6-DOF" at column 6, line 7; figure 17, "Position and Orientation Output") using a machine vision system ("robot and machine control" at column 10, line 7; e.g., figure 17) comprising:

a search tool of the machine vision system (figure 17, the functional block labeled "The Subject of Invention" is a search tool) adapted to recognized a plurality of instances of a trained pattern ("each model vector is matched ..." at column 7, line 65), the plurality of instances of each being transformed to exhibit different amounts of aspect and shear ("the model is rotated about its object coordinate center in pitch, roll and yaw over the entire angular range" at column 7, line 51; NOTE: The applicant defines "aspect" as changes in either "roll" or "pitch" at specification page 3, lines 25, 29 and 30; the applicant defines "shear" as changes in both "roll" and "pitch" at specification page 4, line 3; Given that Peurach changes the model's roll, pitch and yaw individually and in combination with each other, the claim limitation of the instances being transformed in different amounts of aspect and shear is met).

Regarding **claims 6, 15 and 24**, the plurality of instances are transposed, synthetically generated image data (the "model" is synthetically, i.e., by computer, transformed as depicted in figure 16), and the different amounts of aspect and shear are

based upon predetermined know increments ("in β degree steps (typically 10 degrees)" at column 7, line 53).

Regarding **claims 8, 17 and 26**, the plurality of instances each comprise portions of the overall pattern (the images are divided into "zones" at column 5, line 8, and "edge" features are used at column 5, line 50; see "in each grid an edge is detected" at column 7, line 43).

Regarding **claims 2, 10 and 19**, a plurality of search results corresponding to a plurality of instances of the trained pattern is provided ("all proposed model and orientations ... may be sorted by the cost value to generated a list of least to most probable orientation hypotheses" at column 8, line 28).

Regarding **claims 3, 11, 14, 20 and 23**, the plurality of results are scored and combined to provide a location of the object in the six degrees of freedom ("the top m% of the models/orientation hypotheses are evaluated" at column 8, line 34; thus, a combination of the top m% are evaluated to yield the location of the object).

4. Claims 1, 9 and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Eibert et al. (US 5,621,807 A).

Regarding **independent claims 1, 9 and 18**, Eibert discloses:

a computer implemented system for registering an object in six degrees of freedom (intended use limitation in the preamble, and not referred back to or recited in the body of the claim; however, Eibert meets this limitation anyway: see "6 degrees of freedom" at figure 2, in the block between numerals 25 and 27; "position and attitude

determination" at column 3, line 50; "three-dimensional position, plus pitch, roll and yaw" at column 5, line 33) using a machine vision system (e.g., "automatic piloting", "work area monitoring", "washing robots", etc. at column 7, lines 1-17) comprising:

a search tool of the machine vision system (figure 2, numeral 25) adapted to recognized a plurality of instances of a trained pattern ("model" at figure 1, numeral 12 and figure 2, numeral 24), the plurality of instances of each being transformed to exhibit different amounts of aspect and shear (at figure 3, numeral 252 and in detail in figure 6, the model is iteratively adjusted in position and attitude until a match with the input image is achieved).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 7, 9, 16, 18 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Peurach et al. (US 6,173,066 B1) and Matsutake et al. (US 5,793,901 A).

Claims 7, 16 and 25 (Peurach in view of Matsutake)

Regarding dependent claims 7, 16 and 25, while Peurach teaches generating a plurality of instances of a trained pattern corresponding to aspect and shear as

described in the rejections above, Peurach does not teach the plurality of instances of the trained pattern comprising plural user-specified values for aspect and shear provided at runtime to the search tool so as to change an orientation of the trained pattern.

Matsutake discloses a system (figure 7) for generating a plurality of instances of a trained pattern (figures 8 and 9) to determine the position and orientation of an object ("angular rotation of the object and the distance of its misregistration in the directions X and Y" at column 13, line 13), wherein Matsutake teaches the plurality of instances of the trained pattern comprising plural user-specified values for rotation provided at runtime to the search tool so as to change an orientation of the trained pattern (figure 7, the user enters the values that the model, or trained pattern will be rotated at runtime; "misrotation specified by the conditions which it received from input device 15" at column 8, line 19; "input device 15 is equivalent to input device 7" at column 8, line 22; regarding input device 7, "the user indicates via input device 7 ... the condition governing misrotation (initial angle, final angle and interval)" at column 6, line 19).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to add an input capability as taught by Matsutake to the system of Peurach, to provide user specified values of aspect and shear to the system of Peurach, in order to provided the user with the ability to control the extent to which, and intervals with which the trained pattern is transformed to obviate mistaken recognition and accidental matching (Matsutake, column 10, lines 53 and 64; Matsutake describes how

a user can alter the amount and extent that the model pattern is transformed to accommodate specific pattern types that could cause recognition errors).

Claims 1, 7, 9, 16, 18 and 25 (Matsutake in view of Peurach)

Regarding **independent claims 1, 9 and 18**, Matsutake discloses:

a computer implemented system (figure 7) for registering an object ("angular rotation of the object and the distance of its misregistration in the directions X and Y" at column 13, line 13) in six degrees of freedom (intended use limitation in the preamble, and not referred back to or recited in the body of the claim; this limitations is not required of the reference) using a machine vision system (figure 7; e.g., an "inspection" system at column 2, line 19) comprising:

a search tool of the machine vision system ("brightness search" at column 9, line 18; figure 7, numeral 19) adapted to recognized a plurality of instances of a trained pattern ("matches any of the rotated images stored in model memory" at column 9, line 22), the plurality of instances of each being transformed to exhibit different amounts of rotation (e.g., as in figure 9).

While Matsutake teaches a brightness search by comparing input image data with pre-rotated model images to determined the position where the model images exist in the input image, Matsutake does not teach the instances of trained patterns exhibiting different amounts of "aspect and shear".

Peurach discloses a computer implemented system in the same field of registering an object in six degrees of freedom, comprising a search tool of the machine

vision system adapted to recognized a plurality of instances of a trained pattern, each being transformed to exhibit different amounts of aspect and shear (as described above: "the model is rotated about its object coordinate center in pitch, roll and yaw over the entire angular range" at column 7, line 51; NOTE: The applicant defines "aspect" as changes in either "roll" or "pitch" at specification page 3, lines 25, 29 and 30; the applicant defines "shear" as changes in both "roll" and "pitch" at specification page 4, line 3; Given that Peurach changes the model's roll, pitch and yaw individually and in combination with each other, the claim limitation of the instances being transformed in different amounts of aspect and shear is met).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to supplement the brightness search tool of Matsutake, by storing in addition to images exhibiting different amounts of rotation (i.e., as is currently done by Matsutake), images of the model that exhibit different amounts of aspect and shear as taught by Peurach (e.g., "pitch, roll and yaw over the entire angular range" as taught by Peurach), to thereby locate the model location in the actual image data with far superior accuracy by accounting for every possible amount of rotation around every axis of the part under inspection (e.g., instead of just rotation, the object under inspection by the Matsutake system could be rotated in pitch, yaw and roll). By locating the model regions in the image data with increased accuracy, the final determination of the Matsutake's "degree of misregistration" (i.e., at column 9, line 51), which is completely based upon the accuracy of the brightness search, would necessarily be of increased accuracy as well.

Obviousness Rationale

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention (MPEP 2141). Matsutake does not teach away from searching and registering using more degrees of freedom. In fact, Matsutake states that "the invention is not limited to this case only" at column 10, line 42).

The rationale to modify or combine the prior art does not have to be expressly stated in the prior art; the rationale may be expressly or impliedly contained in the prior art or it may be reasoned from knowledge generally available to one of ordinary skill in the art, established scientific principles, or legal precedent established by prior case law (MPEP 2144). One of ordinary skill in the art would reasonably be apprised that searching for the model patters of Matsutake using additional degrees of freedom would increase the accuracy with which the locations are found as described in the rejection above.

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification (MPEP 2143). The proposed modification to Matsutake would not render the invention unsatisfactory. Rather, it would render it more satisfactory for the reasons stated in the rejection above.

The prior art can be modified or combined to reject claims as prima facie obvious as long as there is a reasonable expectation of success (MPEP 2143). The examiner

contends that there would be a complete expectation of success, as the operating principles of the Matsutake system are supplemented by the modification.

Regarding **claims 7, 16 and 25**, Matsutake discloses the plurality of instances of the trained pattern comprising plural user-specified values for rotation provided at runtime to the search tool so as to change an orientation of the trained pattern (figure 7, the user enters the values that the model, or trained pattern will be rotated at runtime; "misrotation specified by the conditions which it received from input device 15" at column 8, line 19; "input device 15 is equivalent to input device 7" at column 8, line 22; regarding input device 7, "the user indicates via input device 7 ... the condition governing misrotation (initial angle, final angle and interval)" at column 6, line 19).

While Matsutake does not teach user-specified values for aspect and shear, it would have been obvious, as part of the above combination of Matsutake and Peurach and for the same reasons and motivation, to have the user specify the values for aspect and shear in addition to rotation angles.

Allowable Subject Matter

7. Claims 4, 5, 12, 13, 21 and 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art does not teach or suggest a combiner that combines a plurality of search results related to a plurality of instances of aspect and shear of the trained pattern to locate an object in six degrees of freedom, where the found relative positions of the instances is compared

with known relative positions of the instances (i.e., as required by dependent claims 4, 12 and 21).

While Matsutake teaches the use of relative position of found patterns (i.e., column 9, lines 45-50) in a manner similar to claims 4, 12 and 21, the Matsutake reference does not meet the combining requirements of dependent claims 3, 11 and 20 from which claims 4, 12 and 21 respectively depend. While Peurach teaches this combining, there is no suggest or motivation without the use of improper hindsight that would properly render the limitations of claims 4, 12 and 21 obvious. That is, the search technique Matsutake teaches away from the combining technique taught by Peurach. In reverse, the relative position determination of Matsutake would not add anything to or even have a reasonable expectation of success if added to the combining of Peurach. Thus, for at least these reasons, the limitations of claims 4, 12 and 21 are not art rejected.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Gee et al. (US 5,459,636 A) is pertinent as teaching most of the elements of at least claim 1 (see figure 3); except for "aspect" and "shear".

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian P. Werner whose telephone number is 703-306-3037. The examiner can normally be reached on M-F, 8:00 - 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau can be reached on 703-305-4706. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4750.

Brian Werner
Patent Examiner
Art Unit 2621
Wednesday, October 15, 2003

BRIAN WERNER
PRIMARY EXAMINER